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**A Note on the Feeding Habit of a Calanoid Copepod,
Pontellopsis yamadae Mori**

By

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With Text-figures 1-2 and Table 1

In contrast to the majority of calanoid copepods, which is planktonic, such calanoids as pontellids are neustonic (e.g., Hattori et al., 1983) and their feeding habits as well as prey-predator relationships around them can be expected to be somewhat different from those of planktonic calanoids. However, our knowledge on feeding habits of neustonic calanoids is still very poor, perhaps because of difficulty in collecting enough material. In my opinion, tedious efforts to accumulate evidences which show their feeding habits are inevitable to clarify their ecological roles in complex food webs in the marine pelagos. In the present paper, along this belief of mine, I report the feeding habit of *Pontellopsis yamadae* Mori (Family Pontellidae) which has become apparent from observation of an adult female collected with a neuston net in the North Pacific off the Kii Peninsula, Japan.

The following observation was made on an adult female of *Pontellopsis yamadae* which was collected during an investigation on the neuston above a depth of 15 cm off Tsubaki on the western coast of the Kii Peninsula (33°37'N, 135°17'E, 12-X-1983) together with other pontellid copepods. The specimen, whose body was 3.02 mm long, was mounted onto a slide-glass with Gum-chloral medium and examined with the differential interference microscope.

Before going further, I would like to express my sincere thanks to Dr. T. Itô of Kyoto University for reading the manuscript. Thanks are also due to Dr. S. Fuse, Messrs S. Sakai and Y. Yamamoto for their cooperation at sea.

The feeding habit of *Pontellopsis yamadae*

The copepod was in the act of ingesting a small chaetognath as shown in Figs 1 and 2-A. Most of the posterior portion of the prey had been swallowed before the sample was fixed in formalin immediately after capture. The chaetognath was firmly grasped by the maxillulae and maxillae of the copepod. Considering the advanced stage of the ingestion of the prey, it is unlikely that the predation occurred

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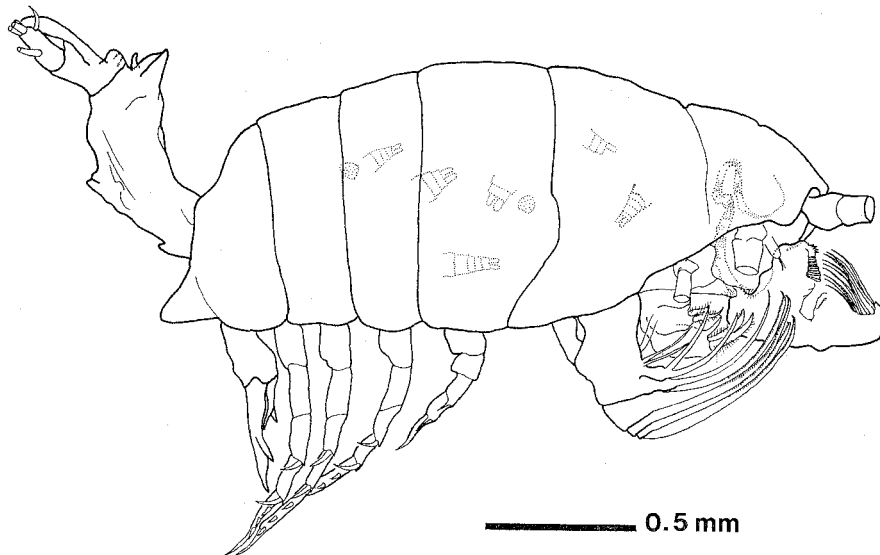


Fig. 1. *Pontellopsis yamadae* feeding a small chaetognath, copepods and tintinnids. Antennule, antenna and mandible of the copepod omitted.

incidentally in the cod end of the neuston net. Evidently the attack on the chaetognath must have taken place in the open water. The number of hook, anterior and posterior teeth of the chaetognath was 12, 4 and 5, respectively. The number was almost equal to those of three species of the genus *Sagitta*: *S. bedfordii* Doncaster, *S. enflata* Grassi, and *S. regularis* Aida (see Alvarino, 1967). The pontellid copepod also preyed on copepodids of the harpacticoid copepod *Euterpina acutifrons* (Dana) and other copepods, and tintinnids (Figs 1 and 2-B, C). The prey copepods were cut into pieces, but the loricae of the tintinnids were neither crushed nor chopped up. It is unlikely that these tintinnid loricae were derived from gut contents of the prey copepods, because every lorica is too large to be swallowed by these prey copepods without chewing. I suppose these tintinnids were taken by this pontellid with filtering activity of her oral appendages and swallowed up, though a possibility that they were derived from gut contents of the prey chaetognath still remains.

Table 1 shows the food items of 13 species of the family Pontellidae. These species are classified into carnivore or omnivore. Although pontellid copepods are generally regarded as typical carnivores, many species feed on phytoplankters as well as zooplankters. *Pontellopsis yamadae* and *Labidocera acuta* (Dana) (copepodid V stage) prey on predacious chaetognaths which feed on many zooplankters such as tintinnids, medusae, cladocerans, copepods, mysids, euphausiids, decapods, appendicularians, fish larvae and chaetognaths (Alvarino, 1965; Ohtsuka, unpublished). Therefore, pontellid copepods are considered to play important ecological roles as high-order predators in neustonic food webs.

Wickstead (1959, 1962) and Davis (1977) reported the predation of the copepods on chaetognaths. The former described the predation of the calanoid copepod *Candacia bradyi* Scott and two poecilostomatid copepods *Oncaea* and *Corycaeus* on

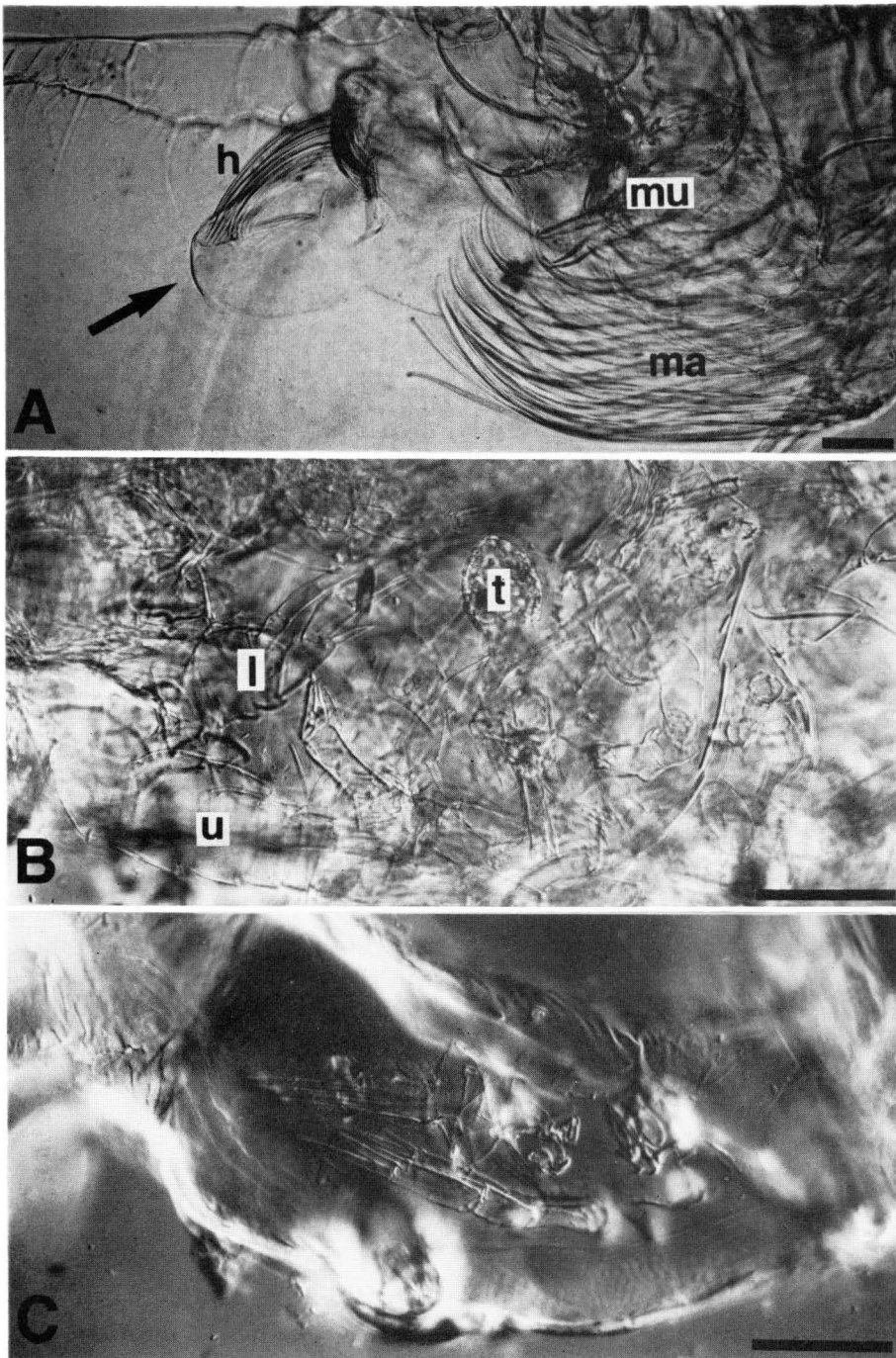


Fig. 2. Food organisms of *Pontellopsis yamadae*. A. Ingestion of a chaetognath by the copepod (the chaetognath indicated by an arrow; h. hook of the chaetognath; mu. maxillula of the copepod; ma. maxilla of the copepod); B. Food organisms in the digestive tube in prosome of the copepod (t. lorica of a tintinnid; l. leg of *Euterpina acutifrons*; u. urosome of *E. acutifrons*); C. Legs of *E. acutifrons* in the digestive tube in urosome of the copepod. All scale bars=0.1 mm.

Table 1. Food items of the family Pontellidae. (1): Analysis of gut contents or fecal pellets; (2): Laboratory feeding experiments.

Species	Food items	Author
<i>Labidocera acuta</i> (copepodid V stage)	radiolarian, tintinnid, medusa, copepod (copepodid & nauplius), chaetognath, silico-flagellate, dinoflagellate, diatom (1).	Ohtsuka (unpublished)
<i>L. aestiva</i>	microcrustacean, diatom (<i>Thalassiosira</i> sp., <i>Chaetoceros</i> sp.) (1). diatom (<i>Thalassiosira fluviatilis</i>), <i>Artemia</i> nauplius (2).	Turner (1978) Anraku & Omori (1963)
<i>L. jollae</i>	anchovy larva (2).	Lillelund & Lasker (1971)
<i>L. trispinosa</i>	anchovy larva, <i>Artemia</i> nauplius (2).	Lillelund & Lasker (1971)
<i>L. wollastoni</i>	copepod, diatom (1).	Lebour (1922)
<i>Pontella meadii</i>	copepod, microcrustacean, diatom (<i>Skeletonema costatum</i> , <i>Amphora</i> sp., <i>Navicula</i> sp., <i>Cymatosira</i> sp., <i>Rhaphoneis</i> sp., <i>Thalassiosira</i> sp., <i>Thalassionema</i> sp., <i>Chaetoceros</i> sp.) (1). diatom (<i>Thalassiosira fluviatilis</i>) (2).	Turner (1978)
<i>Pontellopsis occidentalis</i>	anchovy larva (2).	Lillelund & Lasker (1971)
<i>Anomalocera ornata</i>	microcrustacean, diatom (<i>Chaetoceros</i> sp., <i>Skeletonema costatum</i> , <i>Stephanopyxis</i> sp.) (1). diatom (<i>Thalassiosira fluviatilis</i>) (2).	Turner (1978)
<i>A. pattersoni</i>	copepod (<i>Euterpina acutifrons</i>), crustacean, diatom (<i>Rhizosolenia shrubsolei</i>), Haptophyceae (<i>Phaeocystis</i>) (1). angler larva (2).	Lebour (1922, 1925)
<i>Pontellina morii</i>	copepod (<i>Oncaea</i> etc.) (1).	Fleminger & Hülsemann (1974)
<i>P. platychela</i>	copepod (<i>Oncaea</i> , <i>Paracalanus</i> etc.) (1).	Fleminger & Hülsemann (1974)
<i>P. plumata</i>	copepod (<i>Oncaea</i> etc.) (1).	Fleminger & Hülsemann (1974)
<i>P. sobrina</i>	copepod (<i>Oncaea</i> etc.) (1).	Fleminger & Hülsemann (1974)

chaetognaths; the latter reported the predation of the calanoid copepod *Acartia longiremis* (Lilljeborg) on a small chaetognath. Davis (1977) emphasized that this species, which had been considered to be herbivorous or omnivorous, was in fact carnivorous, at least, while the phytoplankters disappeared nearly completely during the long winter night in high latitude (69°–70°N) in northern Norway. These phenomena that some copepods actually feed on predatory chaetognaths which prey on many zooplankters are most important in consideration of the complexity of the marine pelagic food webs. However, it should never be overlooked that the mutual relationship between the prey and predator may change with their developmental stages. Nauplius larvae of a copepod, whose copepodids are even carnivorous, become the prey of chaetognaths and, contrary, the carnivorous copepod copepodids may prey on chaetognaths.

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